



PATENT

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of:

LOVELL, et al.

Serial No.: 10/600,117

Filed: June 20, 2003

Atty. File No. 2060-92

For: "HIGH CAPACITY  
REGENERABLE SORBENT FOR  
REMOVAL OF ARSENIC AND  
OTHER TOXIC IONS FROM  
DRINKING WATER"

) Group Art Unit: 1725

) Examiner: JOHNSON, CHRISTINA ANN

DECLARATION OF  
THOMAS E. BRODERICK  
UNDER 37 CFR § 1.98

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

I, Thomas E. Broderick, being over the age of eighteen, declare as follows:

1. I am an employee of ADA Technologies, Inc. ("ADA") and a named inventor of the above-identified application. I am a shareholder of ADA and may receive additional financial compensation for the issuance of the above-identified application.

2. This Declaration is being submitted in connection with prosecution of the above-referenced patent application.

3. I received a B.S. in Chemistry in 1979 and a M.S. in Chemical Engineering in 1984 from the University of Wyoming. From July, 1994, to March, 1996, I was employed by ERM and completed several projects for the Department of Energy Rocky Flats Environmental Technologies Site related to remedial design and process

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development for treatment of low-level radioactive and mixed wastes. I have been employed as a Senior Research Engineer by ADA since 1996. In that capacity, I have developed several contaminant control technologies that address problematic wastes and industrial process streams. I am thus qualified as one of ordinary skill in the art of contaminant removal from various fluids using sorbents.

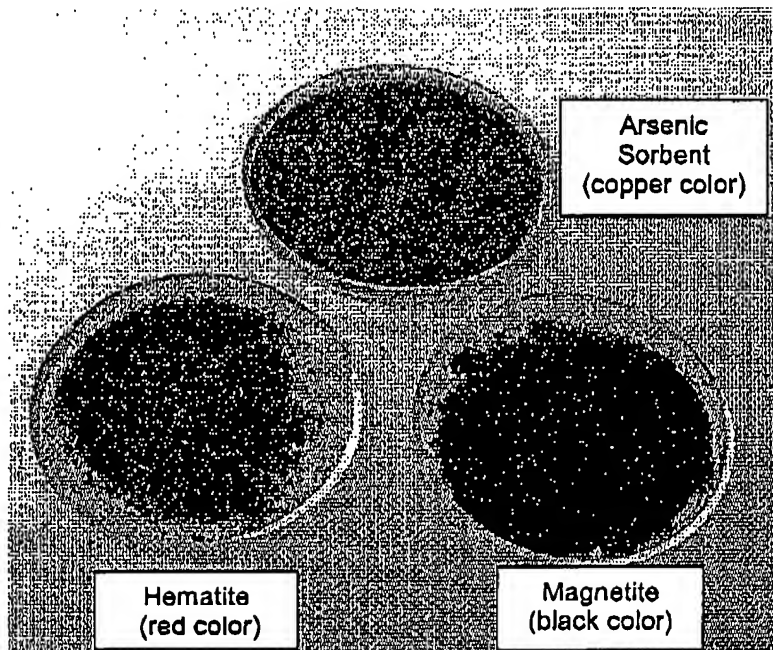
4. In regards to the above patent application, the Examiner has cited several prior art patents that use substrates with an alumino-silicate composition (i.e., Montmorillonite clays) and are subsequently contacted with a solution containing metal cations to perform an ion-exchange process with the substrate. In the patents cited, the ion-exchanged substrate materials are heated (calcined) at high temperatures ranging from 300 - 600°C to form metal oxide compounds.

5. Although the ADA arsenic sorbents are prepared on an alumino-silicate material (vermiculite rather than clay), a substantial difference between ADA's arsenic sorbent manufacturing process and the catalyst manufacturing process lays in the fact that the ADA arsenic sorbents are not calcined as are all the catalytic materials.

6. In ADA's manufacturing process a phyllosilicate, such as vermiculite, is contacted with a metal (e.g., iron) salt solution and then neutralized with sodium hydroxide, ammonia, or other base to form nano-scale crystallites of Akagenite, a metal (e.g., iron) oxy-hydroxide compound ( $\text{FeO} \cdot \text{OH}$ ). This is the active sorbent component responsible for the removal of arsenic from water. These manufacturing steps are carried out at or near room temperature. The sorbent can be dried if desired, but some residual water content is believed to be important to maintain the desired iron oxy-hydroxide phase. It is my understanding that if the ADA arsenic sorbent material were calcined in

accordance with the cited patents, the ADA arsenic sorbent would lose its chemical properties needed for effective arsenic removal.

7. This understanding is based on experimental observations. ADA has exposed samples of the ferric oxide-hydroxide sorbent to temperatures of 700°F to investigate how the sorbent would be affected. A sorbent sample heated in the presence of carbon monoxide turned black in color and was found to be magnetic, indicating that the ferric



oxide-hydroxide had been reduced to magnetite ( $\text{Fe}_3\text{O}_4$ ). A second sample of the ferric oxide-hydroxide sorbent was heated in a nitrogen atmosphere and it turned to a reddish, non-magnetic form of iron(III) oxide called hematite ( $\text{Fe}_2\text{O}_3$ ). In both experiments when the arsenic-binding ferric oxide-hydroxide sorbent was exposed to temperatures similar to calcinations temperatures stated in the cited patents, the sorbent material was transformed by dehydroxylation to form an iron oxide compound. These iron oxide forms have lower capacity for arsenic.

8. I hereby declare that all statements made herein of my own are true and all statements made on information and belief are believed to be true, with the knowledge

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that willful false statements may jeopardize the validity of the subject application or any patent issuing thereon.

Date: 11/28/05

By:   
Thomas E. Broderick

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